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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to a transmission type liquid crystal display provided with the back light device which supplies the display light emitted from many light emitting diodes to transmission type display panels, such as a transmission type liquid crystal display (LCD:Liquid Crystal Display), and this back light device.
[Background of the Invention]
[0002]
As compared with a cathode-ray tube (CRT:Cathode-Ray Tube), a liquid crystal display The formation of a large-sized display screen, Since a weight saving, slimming down, low-power-consumption-ization, etc. are attained, it is used for a television receiver or various kinds of displays, for example with spontaneous light type PDP (Plasma DisplayPanel) etc. A liquid crystal display encloses a liquid crystal between the transparent substrates of two sheets of various sizes, by impressing voltage, it changes direction of a liquid crystal element, changes light transmittance, and displays a predetermined picture etc. optically.
[0003]
It has a back light unit as which a liquid crystal display functions, for example on the back part of a liquid crystal panel as a light source since the liquid crystal itself is not a photogen. A back light unit is provided with a primary light source, a light guide plate, a reflection film, a lens sheet, or a diffusion plate, for example, covers the whole surface to a liquid crystal panel, and supplies display light. Although the cold cathode fluorescent lamp (CCLF:Cold Cathode Fluorescent Lamp) which enclosed mercury and a xenon in the fluorescent tube as a primary light source conventionally is used for the back light unit, Or a life with low light emitting luminance which a cold cathode fluorescent lamp has is short, the issue which a low

luminance area exists in the negative pole side, and must solve problems, like regularity etc. are bad occurs.

[0004]

In the liquid crystal display of large size, it has the area light type back light (Area Litconfiguration Backlight) device which generally arranges two or more long picture cold cathode fluorescent lamps at the back of a diffusion board, and supplies display light to a liquid crystal panel. Also in this area light type back light device, the problem of a rise in luminosity or a raise in regularity is more remarkable in a large-sized television receiver which must solve the problem resulting from the cold cathode fluorescent lamp mentioned above, and exceeds especially 40 inches.

[0005]

As blue the light emitting diode to the back side of a diffusion film which replaces with the cold cathode fluorescent lamp mentioned above in an area light type back light device as many red of the Kozo primary color, and green (LED is called hereafter.) The LED area light type back light which arranges LED:Light Emitting Diode to two dimensions, and acquires white light attracts attention. As for this LED back light device, while cost reduction is planned with low-cost-izing of LED, a high-intensity display is made to be performed to a large-sized liquid crystal panel by low power consumption.

[0006]

In various back light devices, various optical members, such as an optical-functions sheet block equalized while performing function conversion of the display light emitted from the light source between the light source unit and the transmission type liquid crystal panel, a diffusion light guide plate and a light diffusion plate, and a reflective sheet, are arranged. In the back light device, generally a light diffusion plate is fabricated with a transparent acrylic resin etc., and while making a part of display light which enters into a light source and the part which counters penetrate, the modulated light pattern which has the function to reflect a part is formed. The patent documents 1 are equipped with the light diffusion plate in which a fluorescent tube and two or more band-like modulated light patterns formed in the field which counters were constituted by many reflecting dots, respectively. By forming reflecting dots so that area may become small as it keeps away from the axis of a fluorescent tube, light transmittance becomes high, and a light diffusion plate acts so that the illumination light equalized as a whole may be emitted, as it keeps away from a fluorescent tube.

[0007]

[Patent documents 1] JP,6-301034,A

[Description of the Invention]

[Problem(s) to be Solved by the Invention]

[0008]

A light diffusion plate is arranged between the light source units which carry out array arrangement of the light source block which mounted a transmission type liquid crystal panel and many LED also in a LED back light device, For example, the correspondence which forms many modulated light patterns as counters this light diffusion plate with each LED, respectively is also taken into consideration. When each modulated light pattern controls penetration / reflective operation of the display light emitted from LED which faces, as display light is supplied to a liquid crystal panel with uniform light volume from the whole surface of a light diffusion plate, a rise in luminosity and high regularity-ization come to be attained.

[0009]

However, in a LED back light device, LED which makes this light diffusion plate produce a big dimensional change, and faces, and a modulated light pattern may be made to generate a position shift by acting on the light diffusion plate which the mass heat generated from many LED fabricated with the acrylic resin etc. In a LED back light device, the position shift of LED which faces a liquid crystal panel, a light source unit, or the dimensional accuracy and the assembling precision pan of a light diffusion plate by variations, such as printing accuracy of a modulated light pattern, and a modulated light pattern may occur.

[0010]

In the LED back light device, since various factors mentioned above were concerned, it was very difficult to position LED and a modulated light pattern precisely. In the LED back light device, while manufacturing members forming with high precision, the precise assembly had to be performed and cost reduction was difficult. In a LED back light device, in connection with enlargement and the rise in luminosity of a liquid crystal display, the position shift of LED and a modulated light pattern also becomes larger, and becomes remarkable [problems, such as an irregular color and generating of a lamp image,] at a liquid crystal panel.

[0011]

From constituting in an area light type, when a light source unit arranges mutually two or more light source blocks which mounted many LED by a predetermined interval in a LED back light device. The phenomenon which the display light emitted to the outer peripheral direction concentrates from both sides between the sequences of each light source block, and the part where luminosity is big generates arises from each LED. There was [in / for this reason / a LED back light device] a problem that the high luminance region of a lateral stripe state produced to the field which countered between each sequence of each light source block of a light diffusion plate, and the irregular color of a lateral stripe arose in a liquid crystal panel.

[0012]

In a LED back light device, although correspondence which forms a modulated light pattern in a light diffusion plate in a big area, or is fabricated with a milky synthetic resin to it is also achieved as opposed to the problem mentioned above, since display light is shaded and light

transmittance decreases substantially, the luminosity of a liquid crystal panel falls. In a LED back light device, when aiming at correspondence of a rise in luminosity by using for example more much LED, increase and power consumption of cost not only become large, but correspondence of bigger generation of heat becomes very difficult.

[0013]

Therefore, the purpose of this invention is as follows.

Have many light emitting diodes and attain the rise in luminosity of a transmission type liquid crystal panel.

Provide the back light device and transmission type liquid crystal display which prevented generating of an irregular color and a lateral stripe.

[Means for Solving the Problem]

[0014]

A back light device concerning this invention which attains the purpose mentioned above, It is arranged between a transmission type display panel and a light source unit which arranges two or more light source blocks which mounted many light emitting diodes by a predetermined interval, While penetrating a part of display light emitted from each light emitting diode, it has a light diffusion plate supplied to a transmission type display panel in the state where it equalized from the whole surface by reflecting a part. A light diffusion plate is fabricated by a transparent resin material, and a back light device forms a modulated light pattern which print formation is carried out to a light source block, each light emitting diode of the principal surface which counters, and each field that counters in light reflex nature ink, and is made to reflect display light. Each modulated light pattern of a light diffusion plate of a back light device is more large-sized than an outer diameter of a light emitting diode, and it is formed in shape which used as a major axis a dip of a direction which intersects perpendicularly to breadth of the length direction of each light source block.

[0015]

In a back light device concerning this invention, a high-intensity display is performed in this display panel by supplying display light emitted from each light emitting diode of a light source block to a display panel via a light diffusion plate. In a back light device, in a light diffusion plate, generating of a partial high luminance region is reduced because a modulated light pattern which faced each light emitting diode and was formed reflects display light, and where display light is equalized from the whole surface of a light diffusion plate, a display panel is supplied. In a back light device, even if some position shifts arise to a light emitting diode and a modulated light pattern which face by an assembly state, where a penetration by a modulated light pattern more large-sized than a light emitting diode and a reflex function were held and display light is equalized from the whole surface of a light diffusion plate, a display panel is

supplied. In a back light device, each modulated light pattern formed longwise controls light transmittance of display light of each direction between sequences of a light source block about display light emitted from each light emitting diode. In a back light device, a highly precise display which prevented generating of an irregular color, a lamp image, or a lateral stripe is made to be performed in a transmission type display panel.

[0016]

A transmission type liquid crystal display concerning this invention which attains the purpose mentioned above is provided with the following.

Liquid crystal panel.

Light source unit.

Optical-functions sheet lamination object.

A diffusion light guide plate, a light diffusion plate, and a reflective sheet.

Two or more light source blocks in which a light source unit mounted many light emitting diodes arrange transmission type liquid crystal display of each other by a predetermined interval, and it supplies display light emitted from each light emitting diode from the back side to a liquid crystal panel. An optical-functions sheet lamination object carries out function conversion of the display light suitably optically with each functional optical sheet, and supplies a transmission type liquid crystal display to a liquid crystal panel. A diffusion light guide plate diffuses display light which entered from one principal surface side inside, emits a transmission type liquid crystal display from the principal surface side of another side, and supplies it to an optical-functions sheet lamination object. A transmission type liquid crystal display is supplied to a diffusion light guide plate in the state where reflected a part and it equalized from the whole surface while a light diffusion plate is arranged by diffusion light guide plate and a predetermined opposed interval and penetrates a part of display light. A light diffusion plate is fabricated by a transparent resin material, and a modulated light pattern which print formation is carried out to a light source block, each light emitting diode of the principal surface which counters, and each field that counters in light reflex nature ink, and is made to reflect display light is formed. Each modulated light pattern of a light diffusion plate is more large-sized than an outer diameter of a light emitting diode, and it is formed in shape which used as a major axis a dip of a direction which intersects perpendicularly to breadth of the length direction of each light source block. A reflective sheet is arranged by light diffusion plate and a predetermined opposed interval at the back side of a light source unit, and a transmission type liquid crystal display reflects in the light diffusion plate side display light reflected with display light and a light diffusion plate which were emitted to an outer peripheral direction from each light emitting diode.

[0017]

In a transmission type liquid crystal display concerning this invention, a high-intensity display is

performed in this liquid crystal panel by supplying display light emitted from each light emitting diode of a light source block to a liquid crystal panel via a light diffusion plate. In a transmission type liquid crystal display, in a light diffusion plate, generating of a partial high luminance region is reduced because a modulated light pattern which faced each light emitting diode and was formed reflects display light, and where display light is equalized from the whole surface of a light diffusion plate, a liquid crystal panel is supplied. In a transmission type liquid crystal display, even if some position shifts arise to a light emitting diode and a modulated light pattern which face by an assembly state, where a penetration by a modulated light pattern more large-sized than a light emitting diode and a reflex function were held and display light is equalized from the whole surface of a light diffusion plate, a liquid crystal panel is supplied. In a transmission type liquid crystal display, each modulated light pattern formed longwise controls light transmittance of display light of each direction between sequences of a light source block about display light emitted from each light emitting diode. In a transmission type liquid crystal display, a highly precise display which prevented generating of an irregular color, a lamp image, or a lateral stripe is made to be performed in a liquid crystal panel.

[Effect of the Invention]

[0018]

According to this invention, a high-intensity display is made to be performed by using many light emitting diodes as a light source. According to this invention, the dimensional change of composition each member, the dimensional accuracy of composition each member, or the assembling precision pan under the influence of the heat generated from each light emitting diode is also received at variations, such as printing accuracy of a modulated light pattern, By an opposed state with each light emitting diode which faces each modulated light pattern being held, and generating of a partial high luminance region being reduced in a light diffusion plate. While reduction of irregular color generating by raise in regularity comes to be achieved with the rise in luminosity of a display panel, reduction of the manufacturing cost of composition each member or assembly cost comes to be achieved. According to this invention, a lateral stripe is prevented from being generated by the display panel by generating of the partial high luminance region in the light diffusion plate produced between the sequences of each light source block being reduced.

[Best Mode of Carrying Out the Invention]

[0019]

Hereafter, the transmission type liquid crystal color liquid crystal display (it is hereafter called a liquid crystal display for short.) 1 shown in the drawing as an embodiment of the invention is explained in detail. The liquid crystal display 1 is used for display panels, such as a television receiver or a display monitor which has a large-sized display screen of 40 inches or more, for example. The liquid crystal display 1 is provided with the following.

As shown in drawing 1 and drawing 2, it is the liquid crystal panel unit 2.
The back light unit 3 which is combined with the back side of this liquid crystal panel unit 2, and supplies display light.
The liquid crystal panel unit 2 comprises the front frame member 4 of frame shape, the liquid crystal panel 5, and the back frame member 6 of the frame shape which puts and holds the outer periphery part of this liquid crystal panel 5 via the spacer 2A, 2B, the guide member 2C, etc. between the front frame members 4.
[0020]
Although the liquid crystal panel 5 omits details, with spacer beads etc., it encloses a liquid crystal between the 1st glass substrate and the 2nd glass substrate which had the opposed interval held, impresses voltage to this liquid crystal, changes direction of a liquid crystal element, and changes light transmittance. As for the liquid crystal panel 5, the transparent electrode of stripe shape, an insulator layer, and an orienting film are formed in the inner surface of the 1st glass substrate. As for the liquid crystal panel 5, a trichromatic light filter, the Oba coated layer, the transparent electrode of stripe shape, and an orienting film are formed in the inner surface of the 2nd glass substrate. As for the liquid crystal panel 5, a deflection film and a phase difference film are joined to the surface of the 1st glass substrate and the 2nd glass substrate.
[0021]
The orienting film which consists of polyimide arranges a liquid crystal element to an interface horizontally, a deflection film and a phase difference film attain colorless-izing and full color-ization whiten and according to a light filter for the wavelength characteristic of display light, and the liquid crystal panel 5 carries out the colored presentation of the reception picture etc. Of course, it may be a liquid crystal panel provided with various composition which is not limited to this structure and is conventionally provided about the liquid crystal panel 5.
[0022]
The light source unit 7 which the back light unit 3 is arranged at the back side of the liquid crystal panel unit 2 mentioned above, and supplies display light, While holding the radiation unit 8 which radiates heat in the heat generated in this light source unit 7, and these light source units 7 and the radiation unit 8, it has the back panel 9 which constitutes the mounting member to the case which it is combined with the front frame member 4 or the back frame member 6, and is not illustrated. The back light unit 3 has an outside dimension which continues and counters the whole surface to the back of the liquid crystal panel unit 2, and where the opposing space part which faces is sealed optically, it is put together.
[0023]
The back light unit 3 comprises two or more light source blocks 11 which have the light emitting diode (LED is called hereafter.) 12 of the optical sheet block 10 and many and by

which array arrangement was carried out. [light source unit / 7] The light source unit 7 is constituted by the light source arrays 11a thru/or 11d of four rows mutually arranged in the transverse direction by the predetermined opposed interval so that the light source block 11 may mention each details later. The light source unit 11 is constituted by two or more light source block objects 21 which each light source arrays 11a thru/or 11d arranged in the length direction, respectively, and have been arranged.

[0024]

The optical sheet block 10 is countered and installed in the back side of the liquid crystal panel 5, and comprises various kinds of optical-functions sheet lamination objects 13, the diffusion light guide plate 14 or the light diffusion plate 15, and reflective sheet 16 grades which laminate an optical-functions sheet. The optical sheet block 10 arranges the optical-functions sheet lamination object 13 by a predetermined opposed interval at the back of the liquid crystal panel 5, and the diffusion light guide plate 14 is lamination **** to the back of this optical-functions sheet lamination object 13.

[0025]

The back panel 9 is comparatively lightweight, by the aluminum material which has mechanical stiffness, presents tabular [of the oblong rectangle which has a size almost equivalent to the outside of the liquid crystal panel 5], and is formed, for example. Also oneself, the back panel 9 is having thermal conductivity, and has the operation which radiates heat in the heat generated from LED12, a circuit component, etc. In the back panel 9, while the peripheral wall section 9a combined with the front frame member 6 is formed in an outer peripheral part, Many fitting parts 9b which attach the optical stud member 17 so that it may mention later, the cash-drawer opening which pulls out the mounting hole or lead which fixes the radiation plate 24 which omits a graphic display, etc. are formed. The radiation unit 8, the light source unit 7, and the liquid crystal panel 5 are piled up to the front face, and the back panel 9 is attached, and is further attached to the fitting part of a case.

[0026]

The optical-functions sheet lamination object 13 changes suitably the display light which is supplied from the light source unit 11 and in which the liquid crystal panel 5 is entered although details are omitted into the display light which has a predetermined optical property. Two or more optical-functions sheets which do so various optical functions, such as a functional sheet which diffuses the functional sheet disassembled into the polarization component which intersects perpendicularly, for example, the functional sheet which compensates the phase contrast of a light wave and plans formation of a wide angle angle of visibility and color protection, or display light, are laminated, and the optical-functions sheet lamination object 13 is constituted. The optical-functions sheet lamination object 13 is not limited to the optical-functions sheet mentioned above, and may be provided with the diffusion sheet etc. of two

upper and lower sides which sandwich the luminance improving film, phase difference film, or prism sheet which aims at improvement in luminosity, for example.

[0027]

The diffusion light guide plate 14 is arranged at the liquid crystal panel [of the optical-functions sheet lamination object 13] 5, and principal surface side which counters, and the optical sheet block 10 enters the display light supplied from the light source block 11 from the back side. The diffusion light guide plate 14 consists of a little thick plate body fabricated with a synthetic resin material, for example, the acrylic resin, polycarbonate resin, etc. of the opalescence which has light guide nature. The light guide of the diffusion light guide plate 14 is carried out to the principal surface side of another side, making it refract and reflect suitably and diffusing the display light which entered from one principal surface side inside, it is emitted from this another side principal surface, and is supplied to the optical-functions sheet lamination object 13. The diffusion light guide plate 14 is laminated by the optical-functions sheet lamination object 13 as shown in drawing 2, and it is attached to the peripheral wall section 9a of the back panel 9 via the bracket member 29.

[0028]

The optical sheet block 10 holds the opposed interval of the diffusion light guide plate 14 and the light diffusion plate 15, and the opposed interval of the light diffusion plate 15 and the reflective sheet 16 by many optical stud members 17, as shown in drawing 2, It has attached to the back panel 9 via this optical stud member 17. The light diffusion plate 15 is the plate material fabricated with the transparent synthetic resin material, for example, an acrylic resin etc., and the display light supplied from the light source block 11 enters. As shown in drawing 3, many modulated light patterns 18 are arranged and formed in the light diffusion plate 15. Although details are omitted, the fitting hole 15a where the optical stud member 17 is attached to a proper position, respectively is formed in the light diffusion plate 15.

[0029]

Each modulated light pattern 18 is formed in many LED12 and the field which counters, respectively at the opposed face with the light source block 11, as shown in drawing 2. Each modulated light pattern 18 is constituting by the light source arrays 11a thru/or 11d of four rows which arranged many LED12 in the transverse direction, respectively, as the light source block 11 mentioned above, and it is formed by four rows while many is arranged in the principal surface of the light diffusion plate 15 by the transverse direction.

[0030]

As shown in drawing 3 and drawing 4, from the outer diameter D of LED12, in the pattern formation field 20 of mist or a big outside, light reflex nature ink is used for each modulated light pattern 18, for example, it is formed by screen printing, respectively. Each modulated light pattern 18 is prepared at a predetermined rate in various kinds of ink raw material agents in

which light reflex nature ink contains a shielding agent and a dispersing agent. In light reflex nature ink, as a shielding agent, for example Titanium oxide, a barium sulfide, Calcium carbonate, silicon oxide, oxidation alumina, a zinc oxide, nickel oxide, calcium hydroxide, a lithium sulfide, a tri-iron tetraoxide, methacrylic resin powder, mica (sericite), kaolin powder, kaolin, bentonite, the end of gold dust, or a pulp fiber is used. Silicon oxide, a glass bead, glass impalpable powder, glass fiber, fluid silicon, crystal powder, gilding resin beads, cholesteric-liquid-crystal liquid, or recrystallization acrylic resin powder is used for light reflex nature ink as a dispersing agent, for example.

[0031]

Each modulated light pattern 18 sets the length of the horizontal axis of the arrangement direction of LED12 within the each light source arrays [11a thru/or 11d] same sequence to W1, as shown in drawing 4, It is formed in the longwise ellipse form set to W2>W1 if the length of the vertical axis of a direction parallel to an each light source arrays [11a thru/or 11d] adjacent sequence is set to W2. As for the modulated light pattern 18, generally, the interval of the printing surface and top part of LED12 is set as about 1.5 mm - 2.5 mm. As for the modulated light pattern 18, W2 is formed [the length W1 of a horizontal axis] for the length of 7 mm - 8 mm (D+1-2 mm), and a vertical axis to LED12 of the diameter D by the outside dimension of 9 mm - 12 mm (W1+2-4mm).

[0032]

Each modulated light pattern 18 constituted as mentioned above reflects the display light which is emitted from LED12 which faces and goes straight on to the light diffusion plate 15, and shades. Therefore, while the light diffusion plate 15 shades about display light in the pattern formation field 20 in which each modulated light pattern 18 was formed, it is made to penetrate by the agenesis part of the modulated light pattern 18. The transmission quantity of the display light by which direct entering is carried out from LED12 which faces by forming the modulated light pattern 18 is adjusted, generating of a partial high luminance region is reduced, and the light diffusion plate 15 acts so that display light may be equalized from the whole surface and the diffusion light guide plate 14 may be supplied.

[0033]

The light diffusion plate 15 is formed in the pattern formation field 20 which has an outside with each bigger modulated light pattern 18 than the outer diameter of LED12 which faces as mentioned above. The light diffusion plate 15 Therefore, the printing accuracy of the size energy or each modulated light pattern 18, Or the penetration control action of display light mentioned above even if some position shifts had arisen in each modulated light pattern 18 and LED12 which originate in the dimensional change pan of expansion by the generating heat from many LED12 and contraction at dimensional accuracy, assembling precision, etc. of composition each member of the liquid crystal display 1 is certainly done so. The light diffusion

plate 15 makes loose the dimensional accuracy and assembling precision of composition each member, and reduction of cost is achieved. The light diffusion plate 15 also has the function reflected on the surface, if a part of display light emitted from each LED12 enters exceeding a seaside angle.

[0034]

By the way, the light diffusion plate 15 has the function to adjust suitably the transmission quantity of the display light emitted from LED12 with the shape of the modulated light pattern 18 mentioned above. Drawing 5 and drawing 6 show the result of having measured the luminosity of each part in the outgoing radiation side principal surface of display light about the light diffusion plate 15 in which two kinds of modulated light patterns 18 of the ellipse form into which the round shape and the size were changed were formed. The right above [LED12 / in / as measurement of luminosity is shown in drawing 5 (A) / the light source array 11a of the 1st row] position P1, the [which is constituted between the light source array 11a of the 1st row, and the light source array 11b of the 2nd row] -- with the middle position P2 of the 1 non-pattern formation field 30a. The right above [LED12 in the light source array 11b of the 2nd row] position P3, the [which is constituted between the light source array 11b of the 2nd row, and the light source array 11c of the 3rd row] -- with the middle position P4 of the 2 non-pattern formation field 30b. As five places of the right above [LED12 in the light source array 11c of the 3rd row] position P5, the surface brightness of the light diffusion plate 15 was measured with the luminance meter, respectively.

[0035]

The light diffusion plate 15 The circular 1st modulated light pattern 18A 7 mm in diameter, The horizontal axis formed in the opposite principal surface of LED12 the 2nd modulated light pattern 18B of the 1st length oblong whose vertical axis is 9.5 mm, and the 3rd modulated light pattern 18C of the 2nd length oblong whose vertical axis a horizontal axis is 11 mm in 7 mm using the same light reflex ink at 7 mm. The light diffusion plate 15 has an interval of the light source array 11a of the 1st row, and the light source array 11b of the 2nd row, and a mutually equal interval of the light source array 11b of the 2nd row, and the light source array 11c of the 3rd row, and they set it to 80 mm - 90 mm.

[0036]

In the light diffusion plate 15A in which the circular 1st modulated light pattern 18A was formed, luminosity falls by the right above [LED12] position P1, P3, and P4 by protection-from-light operation of the display light by the 1st modulated light pattern 18A so that clearly from the measurement result of the luminosity shown in drawing 5 and drawing 6. In the light diffusion plate 15A, luminosity becomes by the light source array middle position P2 and P4 which counter the non-pattern formation fields 30a and 30b in mm2 and not less than 6300cds /. In the light diffusion plate 15A, although about 6200cds/mm, and 2 and a rise in

luminosity are attained for the whole average luminance, the luminance difference two of about 400cds/mm arises in a low luminance area and a high luminance region. In the light diffusion plate 15A, it is that the light source array middle position P2 and the display light emitted to the outer peripheral direction from LED12 in P4 concentrate, and a high luminance region parallel to LED rows will produce, and it will be generated by the lateral stripe. In the light diffusion plate 15A, an irregular color occurs by the position shift of LED12 and the 1st modulated light pattern 18A.

[0037]

In the light diffusion plate 15B in which the 2nd modulated light pattern 18B of the 1st length oblong was formed, luminosity falls by the right above [LED12] position P1, P3, and P4 by protection-from-light operation of the display light by the 1st modulated light pattern 18A so that clearly from the measurement result of the luminosity shown in drawing 5 and drawing 6. In the light diffusion plate 15B, although equalization of the direction which intersects perpendicularly with LED rows with the elliptical 2nd modulated light pattern 18B comes to be attained and it becomes high-intensity somewhat in the non-pattern formation fields 30a and 30b, the luminance difference of a low luminance area and a high luminance region is about 180cds/mm2. In the light diffusion plate 15B, generating of a lateral stripe is reduced by generating of a high luminance region parallel to LED rows being controlled. In the light diffusion plate 15B, although it falls a little rather than the light diffusion plate 15A which the whole average luminance is a grade which is a little less than two in about 6100cds/mm, and mentioned above, sufficient luminosity is secured practical. However, in the light diffusion plate 15B, by the position shift of LED12 and the 2nd modulated light pattern 18B, a high luminance region may occur in the arrangement direction of LED12, and an irregular color may occur.

[0038]

In the light diffusion plate 15C in which the 3rd modulated light pattern 18C of the 2nd length oblong was formed, equalization of luminosity comes to be further attained rather than the light diffusion plate 15B mentioned above so that clearly from the measurement result of the luminosity shown in drawing 5 and drawing 6. In the light diffusion plate 15C, generating of a lateral stripe is certainly prevented by controlling substantially generating of a high luminance region parallel to LED rows. In the light diffusion plate 15C, a practical rise in luminosity is attained from the whole average luminance exceeding two in about 6100cds/mm. In the light diffusion plate 15C, even if a position shift arises to LED12 and the 2nd modulated light pattern 18B, those opposed states are held, generating of a high luminance region is lost, and generating of an irregular color is certainly prevented by the large-sized 3rd modulated light pattern 18C.

[0039]

Although the light diffusion plate 15 was formed in the pattern formation field 20 which has a

bigger outside than the outer diameter of LED12 which faces as the modulated light pattern 18 was mentioned above with elliptical [longwise], the modulated light pattern 18 is not limited to elliptical [this]. It may be made to form the modulated light pattern 18 in proper shape, such as a pattern of a longwise rectangle and polygon, and a longwise ellipse pattern. Although the light diffusion plate 15 formed the modulated light pattern 18 in the pattern formation field 20 as a solid coating pattern, it may be made for many dot patterns to constitute it, for example. It may be made for the modulated light pattern 18 which consists of this dot pattern to constitute the light diffusion plate 15 as what is called a gradation pattern that made dot density of the center section larger than the dot density of a periphery. The modulated light pattern 18 is not limited to the dimension value mentioned above, and is suitably determined according to the specification of the liquid crystal display 1.

[0040]

The reflective sheet 16 reflects the display light reflected on the modulated light pattern 18 and the surface of the light diffusion plate 15, and the display light emitted to the outer peripheral direction from LED12, and is again entered in the light diffusion plate 15. The reflective sheet 16 is fabricated by the fizz PET (polyethylene terephthalate) material which contained the fluorescence agent, for example. Since a fizz PET material has the feature that the crack of a reflector is not conspicuous in a different color tone from a metallic luster color while having about 95% of high reflectance characteristics, the reflective sheet 16 reflects display light efficiently. the reflective sheet 16 carries out repeated reflection of the display light between the light diffusion plates 15 -- increase -- a reflection principle -- it also has the function to aim at improvement in the reflectance to depend. It may be made to form about the reflective sheet 16 with silver, aluminum, or stainless steel etc. which has a mirror plane, for example. The reflective sheet 16 may stick and constitute the fizz PET material mentioned above, for example to the aluminum plate.

[0041]

In the optical sheet block 10, it has many optical stud members 17, While covering the whole surface and making it held with sufficient accuracy, the parallelism between the principal surfaces where the light diffusion plate 15 and the reflective sheet 16 face by these optical stud member 17, It is constituted so that the whole surface may be covered and the parallelism between the principal surfaces where the diffusion light guide plate 14 and the light diffusion plate 15 face may be held with sufficient accuracy. The optical stud member 17 is fabricated by one with the synthetic resin material of the opalescence which has light guide nature, mechanical stiffness, and a certain amount of elasticity, such as poly carbo resin, for example. The optical stud member 17 is attached to the fitting part 9b of the approximately trapezoid heights formed in the inner surface of the back panel 9 at one as shown in drawing 2, respectively.

[0042]
The upper surface of the fitting part 9b constitutes the mounting surface of the reflective sheet 16, the mounting hole 9c penetrates, respectively and the back panel 9 is formed. The light diffusion plate 15 and the reflective sheet 16 are positioned on the bottom 9d to the back panel 9 via each optical stud member 17, and the optical sheet block 10 is put together, respectively. Corresponding to the mounting hole 9c established in each fitting part 9b by the side of the back panel 9, many fitting holes 15a and 16a are formed in the light diffusion plate 15 and the reflective sheet 16, respectively.
[0043]
The fitting part 17b by which each optical stud member 17 was formed in the shaft shape base 17a and the base end of this shaft shape base 17a, respectively, It comprises the 1st backing plate part 17c of the flange shape formed in the circumference of the circumference of the shaft shape base 17a by the predetermined interval from this fitting part 17b at one, and the 2nd backing plate part 17d of the flange shape formed in the circumference of the circumference of the shaft shape base 17a by the predetermined interval from this 1st backing plate part 17c at one. Each optical stud member 17 is formed by the axial length as whom the shaft shape base 17a specifies the opposed interval of the fitting part 9b of the back panel 9, and the diffusion light guide plate 14, and the step 17e is formed in the predetermined height position from the 2nd backing plate part 17d.
[0044]
The shaft shape base 17a presents the major axis conical shape which made the step 17e the byway gradually toward the tip part while being considered as the major diameter rather than the fitting hole 15a of the light diffusion plate 15, and each optical stud member 17 is formed. each optical stud member 17 -- the shaft shape base 17a -- the step 17e -- it is located a little up and 17 f of meat theft holes of shaft orientations are formed. That outer diameter is formed in the shaft shape base 17a in the range of the part made into the major diameter rather than the fitting hole 15a of the light diffusion plate 15, and 17 f of meat theft holes give a convergence habit to this part.
[0045]
Each optical stud member 17 is formed by the interval at which the 1st backing plate part 17c and the 2nd backing plate part 17d hold the opposed interval of the light diffusion plate 15 and the reflective sheet 16. As for each optical stud member 17, the shaft shape base 17a is mostly formed in an equal diameter with the fitting hole 15a of the light diffusion plate 15 in the part of the 1st backing plate part 17c and the 2nd backing plate part 17d. While the fitting part 17b is made into an outer diameter almost equal to the mounting hole 9c by the side of the back panel 9 in the outer diameter of a tip part, as for each optical stud member 17, the section gradually made into the major diameter rather than the mounting hole 9c is presenting the

shape of approximate circle frustum to shaft orientations. Each optical stud member 17 is given a convergence habit when the fitting part 17b forms 17 g of slitting toward the tip side from a major-diameter part.

[0046]

The shaft shape base 17a makes the interval of the fitting part 17b and the 1st backing plate part 17c almost equal to the thickness of the back panel 9, and the thickness of the light diffusion plate 15, and each optical stud member 17 is formed. The 2nd backing plate part 17d is made into a major diameter rather than the fitting hole 16a of the reflective sheet 16, and each optical stud member 17 is formed while the 1st backing plate part 17c is made into a major diameter rather than the fitting hole 15a of the light diffusion plate 15.

[0047]

In the optical sheet block 10, on the fitting part 9b of the back panel 9, the reflective sheet 16 carries out the opposed position of the mounting hole 9c and the fitting hole 16a which face, and is put together. In the optical sheet block 10, the fitting part 17b is stuffed into each optical stud member 17 from the fitting hole 16a side of the reflective sheet 16 from the bottom 9d side of the back panel 9. In the optical sheet block 10, after the fitting part 17b converges by the operation which is 17g of slitting and penetrates the mounting hole 9c by the side of the back panel 9, it is returning to a natural state, and the slip off stop of each optical stud member 17 is carried out, and it is attached in the state of a set-up on the fitting part 9b.

[0048]

In the optical sheet block 10, when each optical stud member 17 pinches the fitting part 9b and the reflective sheet 16 to a thickness direction between the fitting part 17b and the 1st backing plate part 17c, where the reflective sheet 16 is positioned to the back panel 9, it holds. In the optical sheet block 10, each optical stud member 17 makes the 1st backing plate part 17c of the shaft shape base 17a to an upper part part project from the reflective sheet 16, respectively, and is set up on the fitting part 9b of the back panel 9.

[0049]

In the optical sheet block 10, to each optical stud member 17, the light diffusion plate 15 makes each fitting hole 15a fit in the tip part 17h which faces, and is put together. In the optical sheet block 10, when each optical stud member 17 converges a major-diameter part by operation of 17 f of meat theft holes, the light diffusion plate 15 is stuffed into shaft orientations. In the optical sheet block 10, to each optical stud member 17, the light diffusion plate 15 overcomes the step 17e, runs against the 2nd backing plate part 17d, and is pinched between these steps 17e and the 2nd backing plate part 17d.

[0050]

Each optical stud member 17 makes the 2nd backing plate part 17d of the shaft shape base 17a to an upper part part project from the light diffusion plate 15 in the optical sheet block 10,

respectively. In the optical sheet block 10, the bottom side can be dashed, and the diffusion light guide plate 14 which piled up the optical-functions sheet lamination object 13 on the tip part 17h of each optical stud member 17 makes, and is attached.

[0051]

In the optical sheet block 10 constituted as mentioned above, While positioning the light diffusion plate 15 and the reflective sheet 16, many optical stud members 17 attached on the bottom 9d of the back panel 9, respectively by the simple method of stuffing the fitting part 17b into the mounting hole 9c, The function to hold precisely the opposed interval of these light diffusion plates 15, the reflective sheet 16 and the diffusion light guide plate 14, and the optical-functions sheet lamination object 13 is done so. In the optical sheet block 10, by having two or more optical stud members 17 mentioned above, while complicated positioning structure and spacing structure become unnecessary, simplification of an assembly process comes to be attained. Compatible use is possible for each optical stud member 17 also to the liquid crystal panel 5 of various sizes, and common use of parts comes to be attained.

[0052]

About the optical stud member 17, it is not limited to the structure mentioned above and a concrete structure of each part is formed by the composition of the optical sheet block 10. Although the fitting part 17b is stuffed into the mounting hole 9c of the back panel 9 and was attached by forming 17 g of slots and a convergence habit being given, for example, the optical stud member 17, For example, it rotates, after fitting in in the mounting hole 9c which formed ****** heights in the peripheral part at one, and formed the key groove in the inner periphery, and a slip off stop may be made to be carried out.

[0053]

In the optical sheet block 10, by positioning each optical member of each other precisely, Since a light guide, diffusion, reflection, etc. are operated where display light is stabilized in the light guide space part H constituted between the diffusion light guide plate 14 and the reflective sheet 16, generating of an irregular color etc. is controlled to the liquid crystal panel 5. It is that diffuse the display light which each optical stud member 17 provided in the light guide space part H is formed by a milky light guide synthetic resin material in the optical sheet block 10, and enters into an inside from the peripheral face, and the luminosity of the tip part 17h is made not to be carried out selectively, It is made for display light to enter from the light guide space part H uniformly to the diffusion light guide plate 14.

[0054]

By having the optical sheet block 10 which the light source unit 7 mentioned above in the back light unit 3, It is made for the display light emitted from each LED12 of the light source block 11 via this optical sheet block 10 to enter efficiently in the state where it was stabilized to the liquid crystal panel unit 2. The light source block 11 is constituted by 9 d of bottoms of the back panel

9 by the light source arrays 11a thru/or 11d of four rows arranged in the transverse direction, respectively, as shown in drawing 8. The light source unit 11 is constituted by two or more light source block objects 21 which each light source arrays 11a thru/or 11d arranged in the length direction, respectively, and have been arranged.

[0055]

As shown in drawing 2 and drawing 8, each light source block object 21 Two or more red LED, green LED, and blue LED (it is named LED12 generically.), It comprises the wiring board 22, a lead wire bundle with a connector which is not illustrated, etc. of an oblong rectangle which put these LED12 in order in the given order and mount it in the length direction on the principal surface 22a. The number of LED12 which mounts the light source block 11 in the row number of a light source array, the number of each light source block object 21, and each with the size of a display screen, the luminescence capability of each LED12, etc. is determined suitably.

[0056]

Although the light source block object 21 omits a graphic display, the land etc. which connect the circuit pattern which connects each LED12 in series, and the terminal of each LED12 are formed in the principal surface 22a of the wiring board 22. Each wiring board 22 is altogether formed by the same specification, it is near the one side part of the cross direction of the principal surface 22a, and it is located in the both sides of a longitudinal direction, and the 1st connector 23a of a signal output side and the 2nd connector 23b by the side of a signal input are mounted.

[0057]

As for the light source block 11, as shown in drawing 7, the light source array 11a of the 1st row, the light source array 11b of the 2nd row and the light source array 11c of the 3rd row, and 11 d of light source arrays of the 4th row make a pair, respectively, When each wiring board 22 makes the side edge side which mounted the connector 23 counter mutually and arranges along with the length direction, each light source block object 21 is constituted. The wiring shortest by connecting the light source block 11 by the lead wire bundle with a connector in which it arranges the 1st connector 23A and the 2nd connector 23B as the wiring board 22 which each sequence adjoins adjoins each other, and it does not illustrate these is made to be performed.

[0058]

The light source block 11 the light source array 11a of the 1st row, the light source array 11b of the 2nd row and the light source array 11c of the 3rd row, and 11 d of light source arrays of the 4th row, The lead wire bundle for a signal output is pulled out between each, and it bundles and pulls out by a clamping circuit and is made to pull out to the back side of the back panel 9 via an opening. In the light source block 11, increase in efficiency of a space and simplification of the wiring process are attained by establishing the maintenance using the space between

each light source array 11a - 11b of the lead wire bundle for signal input and output, and guide structure. While each wiring board 22 constructs [each light source arrays 11a-11d] by the position of the 1st connector 20a and the 2nd connector 20b and between **** is prevented in the light source block 11, Simplification of the wiring structure between the wiring boards 22 or a wiring process or communalization of the lead wire bundle for signal input and output is attained.

[0059]

The light source block object 21 arranges and mounts red LED, green LED, and blue LED which put the proper number together as mentioned above on the same axis in this order on the principal surface 22a of the wiring board 22. Although each LED12 omits details, while a light emitting device is held at a resin holder, respectively, the terminal is pulled out from the resin holder. Each LED12 also generates heat in that case while emitting display light from a light emitting device.

[0060]

The light source unit 7 will be in the state where the heat generated, respectively became big quantity of heat from many LED12, and it was filled in the light guide space part H from constituting the light guide space part H where the circumference was sealed at the back side of the optical sheet block 10 combining the light source block 11 as mentioned above. The back light unit 3 radiates heat efficiently in the heat with which the light guide space part H is filled with the radiation unit 8, Destabilization of operation of the electronic parts etc. which constitute the characteristic change of each optical sheet object which the optical sheet block 10 mentioned above, destabilization of the lighted condition of each LED12, the irregular color of the liquid crystal panel 5, and a circuit part is controlled.

[0061]

each light source array 11 which mentioned the radiation unit 8 above -- with two or more radiation plates 24 which are provided every a-11d and serve as the mounting member of the light source block object 21. It is constituted by the heat sink which was attached to these radiation plates 24, respectively, by which many both ends of these heat pipes 25 are connected with the heat pipe 25 of a book and which is not illustrated, the cooling fan which promotes the cooling function of a heat sink, etc. The radiation unit 8 attaches the heat pipe 25 to each radiation plate 24 at one, and constitutes the efficient thermal conduction passage to a heat sink so that details may be mentioned later.

[0062]

It excels in thermal conductivity, the aluminum material whose processability is it is good and lightweight and cheap is used, and each radiation plate 24 is formed in long picture rectangular plate shape almost equal to the length and width of each light source arrays [11a-11d] which were mentioned above with extrusion. Since it serves as the mounting member of the light

source block object 21, each radiation plate 24 is formed by the predetermined thickness which has mechanical stiffness. It is not limited to an aluminum material, but thermal conductivity is good, for example, it may be made to form about each radiation plate 24 by the aluminum alloy material, Magnesium alloy material or silver alloy material, a copper material, etc. When comparatively small, each radiation plate 24 is formed by press working of sheet metal, logging processing, etc., for example, and fixes the wiring board 22 by a mounting screw on the principal surface 24a.

[0063]

The heat pipe fitting recess 24b which the section which fits the heat pipe 25 into the back side becomes from the concave of an approximately arch mold configuration is formed in each radiation plate 24. The heat pipe fitting recess 24b is formed by forming by a little small height (depth) by the aperture shape which can carry out tentative holding of the heat pipe 25 without passing an attachment component etc. while having aperture width almost equal to the outer diameter of the heat pipe 25. Each radiation plate 24 arranges the heat pipe 25 in a near position with the heat pipe fitting recess 24b by the LED mounting region of the wiring board 22 where temperature becomes high most.

[0064]

The heat pipe 25 is a member generally [in order to perform heat conduction to a radiation means from the power supply section etc. which become an elevated temperature in various kinds of electronic equipment] adopted, Where the inside of metal pipe materials, such as copper excellent in thermal conductivity, is exhausted, conduction media, such as water evaporated at a predetermined temperature, are enclosed, and it is constituted, and it has highly efficient heat-conduction capability. The heat pipe 25 is attached to each radiation plate 24 in one, as mentioned above, and both ends are connected with a heat sink with each radiation plate 24. In the heat pipe 25, the conduction medium enclosed with the inside in response to heat conduction from the radiation plate 24 by the side of an elevated temperature evaporates from a fluid to a gas. In the heat pipe 25, by flowing through the inside of a pipe into a terminal area with the heat sink 26 by the side of low temperature, and being cooled, the vaporized conduction medium emits the heat of condensation, and liquefies. the length direction which the liquefied conduction medium formed in the wall of a metallic pipe in the heat pipe 25 -- many -- it is that move the inside of the slot of several sections, or a porous layer to the radiation plate 24 side according to capillarity, and circulation in a pipe is performed, and a highly efficient heat-conduction operation is done so.

[0065]

In the radiation unit 8, it becomes the composition of having approached and having made this heat pipe 25 extending just under the array area of each LED12 of a heating source, by unifying and attaching to the radiation plate 24 of composition of having mentioned above the

heat pipe 25 which has highly efficient heat-conduction capability. In the radiation unit 8, the wiring board 22 which mounted each LED12, and the radiation plate 24 and the heat pipe 25 holding this wiring board 22 are piled up in the state where it stuck mutually, and constitute the conductor to a heat sink. It is planning space efficiency by this composition, conducting the generating heat from each LED12 to a heat sink very efficiently, and radiating heat in the radiation unit 8, Display light is supplied to the liquid crystal panel 5 in the operation which reduced the temperature rise of the light guide space part H and in which the back light unit 3 was stabilized.

[0066]

In the liquid crystal display 1 constituted as mentioned above, the light source unit 7 which mounted many LED12 in two or more light source blocks 11 which carried out array arrangement is used as a light source, and the display light of the high capacity emitted from each LED12 is supplied to the liquid crystal panel unit 2 via the optical sheet block 10. In the liquid crystal display 1, heat is efficiently radiated in the heat generated from each LED12 with the radiation unit 8. In the liquid crystal display 1, the light diffusion plate 15 which constitutes the optical sheet block 10 regulates incidence of the direct ingredient of the display light emitted by the modulated light pattern 18 from each LED12.

[0067]

In the liquid crystal display 1, improvement in optical efficiency is achieved by reflecting the display light reflected with the light diffusion plate 15 with the reflection plate 16, and entering into the light diffusion plate 15. In the liquid crystal display 1, the display light which removed the partial high luminance component and was equalized from the whole surface of the light diffusion plate 15 is emitted, and the diffusion light guide plate 14 is supplied. In the liquid crystal display 1, it equalizes further by reflecting and making display light suitably refracted inside the diffusion light guide plate 14, and this display light is supplied to the optical-functions sheet lamination object 13. In the liquid crystal display 1, operation changed into the display light which has a predetermined optical property in the optical-functions sheet lamination object 13 is performed, and display light is supplied from this optical-functions sheet lamination object 13 to the liquid crystal panel 5.

[0068]

In the liquid crystal display 1, each modulated light pattern 18 counters the light diffusion plate 15 each LED12, respectively, it is formed in the right above position, and generating of a high luminance region is reduced by reflecting the direct ingredient of display light with each modulated light pattern 18. In the liquid crystal display 1, the display light by which each modulated light pattern 18 formed in the longwise ellipse form a little more large-sized than the outer diameter of LED12 and was emitted to the outer peripheral direction from each LED12 reduces generating of the high luminance region of the shape of a lateral stripe which

condensed in each light source array 11a-11d. In the liquid crystal display 1, the position shift of each modulated light pattern 18 and each LED12 is made to be absorbed also to the dimensional change resulting from a thermal change, part precision, or assembling precision.

[0069]

In the liquid crystal display 1, the light guide of the display light of the high capacity emitted from each LED12 is efficiently carried out to the liquid crystal panel 5. In the liquid crystal display 1, the high-intensity and highly precise display which prevented generating of an irregular color, a lamp image, or a lateral stripe in the liquid crystal panel 5 by the display light which continued the whole surface from the light diffusion plate 15, and was equalized being emitted comes to be performed.

[Brief Description of the Drawings]

[0070]

[Drawing 1]It is an important section exploded perspective view of the transmission type liquid crystal display shown as an embodiment.

[Drawing 2]It is important section drawing of longitudinal section of a liquid crystal display.

[Drawing 3]A light diffusion plate is shown, the figure (A) is an important section top view, and the figure (B) is important section drawing of longitudinal section.

[Drawing 4]The composition of a modulated light pattern is shown, the figure (A) is an important section top view, and the figure (B) is important section drawing of longitudinal section.

[Drawing 5]It is a figure showing the measurement result of the luminosity in the light diffusion plate in which the modulated light pattern which differs in shape was formed.

[Drawing 6]It is a graph which shows the measurement result of luminosity.

[Drawing 7]It is an important section top view of a light source unit.

[Drawing 8]It is an important section perspective view of a light source block.

[Description of Notations]

[0071]

1 A liquid crystal display, 2 liquid crystal panel units, and 3 Back light unit, 5 A liquid crystal panel, 7 light source units, 8 radiation units, and 9 Back panel, 10 An optical sheet block, 11 light source blocks, 12 light emitting diodes (LED), 13 An optical-functions sheet lamination object and 14 A diffusion light guide plate, 15 light diffusion plates, 16 A reflective sheet and 17 An optical stud member, 18 modulated light patterns, and 19 A modulated light dot, 20 pattern-formation field, 21 light source block objects, 22 wiring boards, 24 radiation plates, and 25 A heat pipe, non-pattern formation field

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[Translation done.]